



Missouri Department of Natural Resources

Biological Assessment Report

Clear Creek Barry and Lawrence Counties

1997 and 2000

Prepared for:

Missouri Department of Natural Resources
Division of Environmental Quality
Water Pollution Control Program

Prepared by:

Missouri Department of Natural Resources
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1.0 Introduction

At the request of the Water Pollution Control Program (WPCP), the Environmental Services Program (ESP) conducted a biological assessment of Clear Creek below the Monett Wastewater Treatment Facility (WWTF). Two studies, separated by an interval of three years, were completed. The first study was conducted March 19, and September 15, 1997, and the second study was conducted March 15, and October 4, 2000. The purpose of the studies was to provide data to the WPCP for evaluating the biological integrity of a stream receiving effluent from a municipal wastewater treatment facility. Steve Humphrey, Dave Michaelson, and other personnel of the Division of Environmental Quality, ESP, conducted the sampling.

In addition to these two studies, two recent water quality investigations have been conducted on Clear Creek and the Monett WWTF by personnel of the ESP. These Stream Survey Sampling Reports were completed in 1999 and 2000. Both are on file at the WPCP.

2.0 Study Area

Clear Creek originates in north Barry County near Monett, Missouri. The four miles of stream above the Monett WWTF are listed in the Missouri Water Quality Standards as a losing stream. The first two miles of Clear Creek below the Monett WWTF are a class "C" stream. The next nine miles of stream to its confluence with the Spring River are class "P." Beneficial use designations for both stream segments are "warm water aquatic life protection, human health/fish consumption, and livestock and wildlife watering." In dry weather, Clear Creek does not have surface flow upstream from the Monett WWTF. Stream flow for several miles below the facility is, therefore, composed almost entirely of WWTF effluent.

Clear Creek is located within the Ozark/Neosho Ecological Drainage Unit (EDU). An EDU is a region in which biological communities and habitat conditions can be expected to be similar. Please see Appendix A for maps of the EDU and sampling locations. Table 1 compares the land cover percentages from the Ozark/Neosho EDU and the 14 digit Hydrologic Unit (HU), #11070207030001, that contains the sampling reach of Clear Creek. Land cover data were derived from Thematic Mapper (TM) satellite data from 1991 to 1993 and interpreted by the Missouri Resource Assessment Project.

Table 1
Percent Land Cover

	Urban	Crops	Grassland	Forest
EDU	0.7	2.5	67.8	27.7
14 digit HU	1.2	0.8	82.5	14.4

3.0 Site Descriptions

Station #1 (NE 1/4, sec. 28, T. 26 N., R. 28 W.), the furthest downstream bioassessment station, was located on Clear Creek in Lawrence County approximately 0.5 mile east of the Pierce City Municipal Park. (This location was assigned Station #4 during each stream survey conducted by the ESP in 1999 and 2000 referred to above.) This station was approximately 3.8 miles downstream from the WWTF. The stream site was accessed through the property owned by George and Stella Velton. Stream width averaged about 25 feet and stream depth in riffle/run areas was approximately 0.5 feet. Discharge was measured in October 2000 and was 3.8 cfs. A substantial quantity of periphyton was present on all cobble and gravel. Stonerollers (Campostoma sp.) were abundant at this location. Livestock had access to the stream. The three standard habitats (coarse substrate, depositional substrate, and rootmat substrate) of a riffle/pool stream as defined in the Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure were present and sampled.

Station #2 (NE 1/4, sec. 35, T. 26 N., R. 28 W.) was located on Clear Creek in Barry County approximately two miles downstream from the WWTF outfall. The sampling location was upstream from the Lawrence/Barry County Line Road (C. R. #2240). This was also the assigned Station #2 for the ESP stream surveys referred to above. The stream was somewhat turbid and had a moderate effluent odor. Short growths of periphyton covered nearly all substrate surfaces. Stream flow in October, 2000 was 4.1 cfs. Coarse, depositional and rootmat substrates were sampled for macroinvertebrates per the Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure.

4.0 Methods

4.1 Macroinvertebrate Collection

A standardized sample collection procedure was followed as described in the Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure.

4.2 Discharge Measurements

Stream velocity was measured using a Marsh-McBirney, Flo-Mate Model 2000. Discharge was calculated per the methods in the Standard Operating Procedure MDNR-FSS-113 (Flow Measurements in Open Channels).

4.3 Chain-of-Custody

All samples received a numbered label affixed to the sampling jar and an internal label after preservation with formalin. The corresponding label number was entered onto a chain-of-custody form indicating the date, time, and location of collection and parameters to be analyzed. The ESP field personnel maintained custody of the samples for analyses.

4.4 Macroinvertebrate Analyses

A standardized sample analyses procedure was followed as described in the Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure.

4.5 Quality Assurance/Quality Control (QA/QC)

QA/QC procedures were followed as described in the Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure.

5.0 Observations

Clear Creek appeared to be at base flow. The creek had no surface flow upstream from the Monett WWTF.

6.0 Results

Data were evaluated as described in the Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure. The following four metrics were used in the evaluation: 1) Total Taxa (TT); 2) Ephemeroptera/Plecoptera/Trichoptera Taxa (EPTT); 3) Biotic Index (BI); and, 4) Shannon Index (SI). The numeric biological criteria for this evaluation were determined by metric values calculated from reference streams within the Ozark/Neoso EDU. Those criteria are listed in Table 2.

Table 2
Biological Criteria for Warm Water Streams in the Ozark/Neosho EDU

	Score = 5	Score = 3	Score = 1
TT	>76	76-39	38-0
EPTT	>28	28-15	14-0
BI	<5.34	5.34-7.66	7.67-10
SI	>2.99	2.99-1.51	1.5-0

The metric values for Clear Creek Station #2 in 1997 are listed in Table 3. Station #1, 1997 is not included because the location was changed in 2000. Clear Creek Stations #1 and #2 in 2000 are listed in Tables 4 and 5, respectively. The values for each metric are scored using the criteria in Table 2. The total score for Station #2 in 1997 is 8 out of a total of 20 in the spring and 10 out of a total of 20 in the fall. In 2000, the total scores for Station #1 are 10 out of a total of 20 for both spring and fall. Total scores for Station #2, in 2000, were 6 out of a total of 20 in the spring and 10 out of a total of 20 in the fall. Three categories of impairment were determined during the development of biological criteria. Stream reaches that score from 20-16 are considered fully biologically sustaining, scores from 14-10 are considered as partially sustaining, and scores of 8-4 are considered non-sustaining.

Table 3
Clear Creek

Sample #	97-0209		97-0239	
Date	3/19/1997		9/15/1997	
	Station #2 Value	Station #2 Score	Station #2 Value	Station #2 Score
TT	28	1	45	3
EPTT	2	1	6	1
BI	6.94	3	7.33	3
SI	1.55	3	2.97	3
Total Score		8		10
Sustainability		Non		Partial

Table 4
Clear Creek

Sample #	00-10104		00-10133	
Date	3/15/2000		10/4/2000	
	Station #1 Value	Station #1 Score	Station #1 Value	Station #1 Score
TT	41	3	53	3
EPTT	5	1	8	1
BI	7.29	3	7.11	3
SI	2.73	3	2.76	3
Total Score		10		10
Sustainability		Partial		Partial

Table 5
Clear Creek

Sample #	00-10105		00-10134	
Date	3/15/2000		10/4/2000	
	Station #2 Value	Station #2 Score	Station #2 Value	Station #2 Score
TT	31	1	43	3
EPTT	3	1	6	1
BI	7.99	1	7.06	3
SI	1.62	3	2.85	3
Total Score		6		10
Sustainability		Non		Partial

7.0 Discussion

Clear Creek Stations #1 and #2 had impaired macroinvertebrate communities with biological ratings varying from partially sustaining to non-sustaining. The major reason for the low biological rating is that the stream is composed of 100% WWTF effluent containing high concentrations of nutrients that remain elevated for several miles downstream. For example, data from the ESP Stream Survey Sampling Reports of Clear Creek in 1999 and 2000 at Station #4 (this study's Station #1), located approximately 3.8 miles below the WWTF, show nitrite plus nitrate levels generally greater than 12 mg/L and total phosphorus concentrations greater than 14 mg/L.

The land cover of Clear Creek sampling stations has higher urban and much higher grassland, and lower forest percentages than the Ozark/Neosho EDU. Thus, urban runoff and livestock impacts are also likely contributors to the impairment of the stream.

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Appendix

Maps

Clear Creek &
Ozark/Neosho EDU